Telephone: MAYFAIR, [illegible].
Telegraphic Address: "[illegible]"

JOHN WEISS

A NEW SCOTOMETER.

By Col. R. H. Elliot, I.M.S.

PARTICULARS ON APPLICATION.

SOLE MAKERS—

JOHN WEISS & SON, LTD.,

287, Oxford Street, London, W.

Instrument Makers to the Royal London Ophthalmic Hospital (Moorfields) and to the principal British and Foreign Hospitals.

CONTRACTORS TO H.M. GOVERNMENT.

Special Orders and Repairs executed with promptitude.

THE BRITISH JOURNAL
OF
OPHTHALMOLOGY

JUNE, 1920

COMMUNICATIONS

TONOMETRY

BY
HJ. SCHIÖTZ,
CHRISTIANIA

(*Concluded*)

Further experiments were undertaken with a rubber bag having the size and shape of an eye, and fitted above with a ring to carry the membrane ordinarily used on the drum. At low water-pressures the difference between the deflection for open and closed connections was very small; at higher pressure and with larger weights it was nil. See Table VI.

If graphs are constructed from Table V. the deflections of the pointer being marked on the abscissa and the pressures in cm. on the ordinates, the top graph will be that of the open drum, congruent with it will be the graph of the closed rubber bag, and only a little below these will come the graph of the rubber bag with the rubber glove. The graph of the closed rubber tube will lie considerably lower, and finally the graph of the closed drum will be the lowest of all.

We thus see that when the tonometer is applied to a vessel with very extensible walls *the same deflections are obtained whether the*

vessel is closed or in open connection with the manometer, the elasticity of the walls equalizing the weight of the tonometer. With more rigid walls the deflections show a decided difference in the two cases, and this difference is greatest when the walls are absolutely rigid.

As the sclera possesses a certain extensibility and as this latter may be safely assumed to vary to some extent owing to varying thickness and other causes, it is evident from what is stated above, that ***the same index deflection does not in all eyes represent the same internal pressure.*** As was found by experiments on dead eyes, the deflections given by the same pressure will vary somewhat, and we shall find maximal and minimal values for them.

TABLE VI

DEFLECTION OF INDEX

Pressure H_2O.	5·5 grm.		10 grm.	
	Open.	Closed.	Open.	Closed.
25 cm.	18 mm.	14·8 mm.	—	—
30 ,, ...	9·9 ,,	7·5 ,,	—	—
40 ,, ...	2·9 ,,	2·5 ,,	19 mm.	16 mm.
50 ,, ...	1·4 ,,	1·3 ,,	10 ,,	10 ,,
60 ,, ...	0·8 ,,	0·8 ,,	6·5 ,,	6·5 ,,
70 ,, ...	0·4 ,,	0·4 ,,	4·5 ,,	4·5 ,,
80 ,, ...	—	—	3 ,,	3 ,,
90 ,, ...	—	—	2 ,,	2 ,,
100 ,, ...	—	—	1·5 ,,	1·5 ,,
110 ,, ...	—	—	1+ ,,	1+ ,,
120 ,, ...	—	—	0·7 ,,	0·7 ,,

The upward limit would be the deflections given by eyes in open communication with the manometer, and who knows whether in some cases the values may not be very close to these. I have in my mind the large, very thinly walled buphthalmic eyes which with the tonometer do not always show any specially high pressure, that is to say the necessary weight is not so heavy nor are the index deflections so slight as might have been expected. If this deflection, however, had been noted on the "open eye," it would have meant a much higher pressure.

Further, I have in mind a rare case of progressive glaucoma simplex in a comparatively young man, where the deflection was 5 mm. with the 5·5 grm. weight (5·5/5). He had large globes with a myopia of 18 D. Now 5·5/5 on the usual graph means a pressure of 18 mm. Hg., on the open graph it signifies over 33 mm. Hg.

Fortunately, the differences do not appear on the whole to be very great, though greater than is desirable. Strictly speaking, each graph

represents the values for the eye experimented on and for no other,[1] and when in spite of this fact we construct graphs according to the average values obtained from the maxima and minima, it should be kept well in mind that they are approximate values only. As pointed out by Priestley Smith, we have here the limitation of the tonometer, and the fact cannot be altered as long as we employ the principle in question. I cannot imagine any method available for living eyes by which the errors due to variations of the envelope could be eliminated.

Below I give the maxima and minima, and also the average values obtained by Priestley Smith's measurements of 12 eyes *in situ*, by my own previous measurements of 8 enucleated eyes, and by my latest measurements of 10 eyes *in situ*.

TABLE VII

Index Deflection (d).	Priestley Smith.			Own previous.			Own recent.		
	Max.	Min.	Middle.	Max.	Min.	Middle.	Max.	Min.	Middle.
d = 1 mm.	40·8	33·4	**37·2**	41	29·5	**35·5**	44.3	38·5	**41**
d = 2 ,,	36	29·5	**32·4**	37	26	**29·5**	40	34	**36·2**
d = 3 ,,	32	25	**28·5**	29·5	22·5	**25**	35	29	**31·5**
d = 4 ,,	28·7	22·2	**25**	25·5	18	**21**	31·7	25·4	**28**
d = 5 ,,	23	17·7	**19·5**	18	12·8	**15·5**	25	19·2	**21**
d = 6 ,,	18·4	13	**15.5**	13	9	**11·5**	19	14	**17**

We will now consider the second factor affecting the deflections, viz., the membrane on which the foot part of the instrument rests. It is obvious that variations in thickness and elasticity in this membrane must influence the depth of the impression made by the plunger. In order to investigate this point, I have used experimentally as cover for the drum a cornea 0·6 mm. thick, a rubber membrane, 1·133 mm. thick, and a rubber membrane of 0·5 mm. thick.

Table VIII gives the values for a graph of the open and closed drum respectively, with these various membranes, using a weight of 5·5 grm.

With regard to the open drum, the variation in the deflections can only be due to the nature of the membrane, all other conditions being identical in the three cases.

If the values given in Table VIII A are made into graphs, the top graph will be that of the cornea, with a comparatively even decline intersecting the others at the level of 70 cm., with zero at 77 cm. water-pressure. The two other graphs lie lower, the intervals between them being about equal (in each case about

[1] *Arch. f. Augenheilk.*, Vol. LII, Part 4, p. 411, 1905.

10 cm.), until both rise steeply, with zero at 90—100 cm. water-pressure. The graph of the thicker rubber membrane is lowest.

It is noteworthy that although it is the thickest of the three the cornea offers the least resistance to the plunger. I presume the reason is that the rubber membranes on account of their elasticity offer a stronger resistance than the cornea, which is more in the nature of a piece of soft skin. That is why the cornea gives a zero point which is much more easily defined than when experimenting with membranes which stretch under the higher pressures, and also yield but little to the plunger. The spherical radius of the

TABLE VIII.

A. Open Drum. Deflection in mm.				B. Closed Drum. Deflection in mm.			
Pressure H_2O.	Cornea 0·6 mm.	Rubber Membrane 0·113 mm.	Rubber Membrane 0·5 mm.	Pressure H_2O.	Cornea 0·6 mm.	Rubber Membrane 0·113 mm.	Rubber Membrane 0·5 mm.
15 cm. ...	—	—	15 mm.	0 cm. ...	8 mm.	—	—
20 ,, ...	—	18·5 mm.	8 ,,	5 ,, ...	5 ,,	15·2 mm.	9·5 mm.
30 ,, ...	15 mm.	8 ,,	4 ,,	10 ,, ...	3·5 ,,	10·8 ,,	6·6 ,,
40 ,, ...	8·1 ,,	4·2 ,,	2·55 ,,	20 ,, ...	1·4 ,,	5·8 ,,	3·3 ,,
50 ,, ...	5.1 ,,	2·6 ,,	1·8 ,,	30 ,, ...	0·45 ,,	3·7 ,,	2·3 ,,
60 ,, ...	2·7 ,,	1·6 ,,	1·3 ,,	40 ,, ...	−0·3 ,,	2·2 ,,	1·6 ,,
70 ,, ...	1 ,,	1·1 ,,	0·9 ,,	50 ,, ...	—	1·4 ,,	1·2 ,,
80 ,, ...	−0·4 ,,	0·5 ,,	0·6 ,,	60 ,, ...	—	0·9 ,,	0·8 ,,
90 ,, ...	—	—	0·4 ,,	70 ,, ...	—	0·7 ,,	0·75 ,,
				80 ,, ...	—	—	0·25 ,,
				90 ,, ...	—	—	0 ,,

cornea does not vary at an increased pressure; it remains the same whether the water-pressure is 10 cm. or 130 cm. The rubber membranes, on the other hand, undergo alterations, the 0·133 mm. membrane being over-distended at a pressure of 90 cm. The radius changes evenly from 11·6 mm. at 10 cm. water-pressure, to 7·25 mm. at 70 cm. water-pressure. At 80 cm. it begins to distend.

If graphs are drawn for the closed drum also (Table VIII B), the remarkable result will be that the cornea graph is here the lowest of the three. The graphs of the thinner and the thicker rubber membranes lie respectively 17 cm. and 13 cm. below their open graphs, and the cornea graph lies 40 cm. below its open graph. The reason must presumably be that in the case of the rubber the narrow edge round the foot of the tonometer yields a little before the inner pressure, and thereby permits the plunger to enter more deeply than in the case of the cornea; the scleral edge of the latter evidently does not yield to the inner pressure at all.

When with open communication we obtain different deflections

on different eyes, the reason can only be the varying resistance in the cornea, either owing to varying thickness or to other causes, and these will, of course, influence the closed eye also, and lead to variation of deflection in various eyes.

The Foot Piece

The deflections of the pointer will be influenced by the curvature as well as by size of the foot. If the spherical radius of the foot is made less than that of the cornea, the plunger will never be pushed up fully, and even with the highest intra-ocular pressures the pointer will show a certain deflection. It should always be greater than that of the cornea in order to ensure the mutual adaptation of the central parts of the foot and the cornea.

If the size of the foot is altered the deflections will be altered. In my tonometer the lower surfaces of the foot and plunger together have an area of 84 sq. mm. If this surface were reduced to, say, 50 sq. mm., the deflections would be perceptibly reduced. The weight of the cylinder (10 grm.) would then rest on a smaller supporting area, a higher internal pressure on each sq. mm. of this area would be needed to counterbalance the weight, and the deflections would decrease in consequence.

For this reason I had difficulty in adjusting a tonometer whose foot-surface was reduced for the purpose of measuring eyes with ulcus serpens. I had to increase the loose weight by half a gramme in order to make the measurements agree with those of the standard tonometer.

A theory has been advanced that the size of the eye affects the readings of the tonometer, wider deflections of the pointer being obtained from large eyes than from small eyes. The experiments described above prove conclusively that the volume of the eye *per se* is of no importance, but the large eye has a larger wall surface than the small eye, and as the yielding of the wall is the decisive factor with regard to the deflection, the latter will necessarily be greater for a large eye than for a small one, other conditions being similar.

Another point must be remembered in measuring small eyes. Very small eyes have small corneas with small spherical radii, and in such cases the foot of the tonometer will not be in contact with the cornea to its full extent. The results will be the same as if the foot were smaller; the deflections will be smaller and the pressure will appear greater than it really is.

Finally, it is important that the upper point of the plunger should touch the short arm of the lever at a point exactly 4 mm. from the fulcrum. If the point of the contact is farther off, the deflections will be smaller; if it is nearer, they will be greater.

Tonometer Graphs

In my first work ("Ein neues Tonometer," *Arch. f. Augenheilk.*, Vol. LII, Part iv., 1905), graphs were given only for the open eye. Fairly numerous measurements on healthy, living eyes had shown me that the upward limit for the normal pressure was a deflection of about 3 mm., and I considered myself justified in stating that a slighter deflection than this was a reason for careful watching of the eye in question.

In my second work ("Tonometrie," *Arch. f. Augenheilk.*, Vol. LXII, Part iv, 1909), the difference between the graphs of open and closed eyes was demonstrated, and fresh graphs were given showing different values in mm. Hg. for the deflections. I expressly stated, however, that these altered values would not falsify the import of the deflections: deflections between 3 mm. and 6 mm. would still, as before, indicate normal pressure in the eye.

As might have been expected, the graphs based on measurements of 8 enucleated eyes prove to have been incorrect; the measurements taken by Mr. Priestley Smith of 12 dead eyes *in situ*, and my own later measurements of 10 eyes give a mean value which lies somewhat higher.

TABLE IX.

Priestley Smith. 5.5 grm.		Schiötz. 5.5 grm.	
Pressure in mm. Hg.	Deflection in mm.	Pressure in mm. Hg.	Deflection in mm.
17·6	7	10	12·3
25	4	20	6·5
32·4	2	30	3·3
39·7	0·4	40	1·15
		46	0

If graphs are drawn according to these values and compared with my previous graphs (Schedule II), the following mean values will be found for the various deflections:

TABLE X.

Priestley Smith.		Schiötz.	
Deflection in mm.	mm. Hg.	Previous values. mm. Hg.	Later values. mm. Hg.
0	42·2	43	46
1	37·8	35·5	41
2	32·4	29·5	36·2
3	25·8	25	31·5
4	25	21	28
6	19·5	15·5	21
8	15·5	11·5	19

It will be seen that Priestley Smith's values at low pressure are lower than my previous values, the difference decreasing with higher

pressures so that the graphs would practically meet at a deflection of 0. My later measurements, as mentioned above, yield values somewhat higher than those found by him.

In Table XI, I give my later measurements with weights of 5·5 grm. and 7·5 grm. Those taken with weights of 10 and 15 grm. were too few for mean values to be computed from them.

TABLE XI.

INDEX DEFLECTIONS IN MM.

Water Pressure in cm.	5·5 grm.		7·5 grm.	
	Open.	Closed.	Open.	Closed.
10	—	15	—	17·4
15	—	11·8	—	14
20	—	9·2	—	11·6
30	12	5·75	17	8·6
40	7·3	3·7	11·2	6·7
50	4·1	1·9	7·7	4·9
60	1·6	0·35	5·4	3·2
70	0	—	3·5	1·85
80	—	—	2	0·6
90	—	—	0·9	—

As will be seen, I measured the open eye also. To this end as much as possible of the vitreous was pressed out, and the eye was thereby perhaps rather roughly handled; this may have influenced the results to some extent.

Mr. Priestley Smith's measurements were conducted in a more gentle manner; they dealt with the "closed" eye only and with the 5·5 grm. weight, one series on each eye, with rising pressures. These measurements are no doubt the more reliable ones, and should be considered standard values for the time being.

The time has not yet arrived to issue fresh graphs. A great number of measurements must be taken if the exact truth is to be attained, although the values found lately can hardly be very wide of those that will be final. Furthermore, a sufficient number of fresh measurements should be made with other weights.

I should like to recommend those who may undertake such measurements to try the insertion of a fine canula into the anterior chamber instead of a larger one into the vitreous. All conduction so easily goes wrong. I previously made an experiment with a canula in the anterior chamber, but unluckily overlooked the capillary attraction in the glass tube and this spoiled the experiment completely. Recently I repeated the experiment with a rather thick hypodermic needle, the point being inserted through the sclera about 2 mm. from the edge of the cornea, and carried into the anterior chamber as far as to the middle of the pupil, the opening

being turned upwards. The hollow needle was closely connected with the glass tube carrying the tap, and this again was connected by a rubber tube with the manometer; the fluid entered and left the anterior chamber easily as the manometer was moved up and down. The needle was not in the way of the tonometer foot. I have not yet had an opportunity of working in this way, but the test was so satisfactory that I recommend the method for further trial.

For the time being, those who wish to transcribe their measurements into mm. Hg., should (on Schedule II), draw up the graph for 5·5 grm. according to the values found by Priestley Smith. (Tables IX and X).

As mentioned above, these changes of Hg. values are of no importance to those who only note the deflections. At present, as before, deflections of between 3 and 6 mm. or more signify the normal intraocular pressure. The only correct method is to note what is really seen, viz., the deflection obtained with a certain weight. I record my measurements in the way advocated by Prof. Bjerrum, viz., in the form of a fraction, the weight employed over the deflection obtained.

TABLE XII.

N.B.—In each case the weight used and the deflection obtained are written as a fraction, e.g., 5·5 (weight) and the approximate mercury equivalent is placed in the adjoining column —— 5·5 (weight). 5 (deflection).

1. Woman, 35 years.				2. Man, 53 years.				3. Man, 75 years.			
Haemorrh. corp. vitr.		Retinitis prolif.		Cataracta senilis.		Glaucoma simplex.		Post. Synechiae.			
mm. Hg.		mm. Hg.		mm. Hg.		mm. Hg.		mm. Hg.		mm. Hg.	
5·5 / 5	16·75	5·5 / 5	18	5·5 / 7·5	13	—		5·5 / 6·5	14·25	5·5 / 6·5	14·25
7·5 / 8·5	14·7	7·5 / 7·25	18	7·5 / 10	11·5	—		—		—	
10 / 11·5	13·5	10 / 10	17	10 / 13·5	12·75	10 / 0·75	74	10 / 11·75	12·8	10 / 11·25	13·8
15 / 15·5	12·5	15 / 14· -	15·75	15 / 17	9·7	15 / 3·5	77	15 / 15·5	12·25	15 / 15·75	12·75
5·5 / 7	13·25	5·5 / 6+	15·25	5·5 / 85	10·7	—		5·5 / 7·25	12·8	5·5 / 7·25	12·8

It should be kept in mind that a given deflection does not indicate a definite pressure in mm. Hg.; it represents a range which is not insignificant, as is shown by the maxima and minima in Table VII. If we fix a deflection of 3 mm. as the limit between normal and pathological pressure, we do so just because it represents a range between the normal and the pathological. The boundary is never sharply defined; it is a range lying probably between 32 and 25 mm. Hg. A deflection of 2 mm., representing the range between 36 and 29·5 mm. Hg. may be assumed in most cases to indicate a pathological pressure.

The use of loose weights which have to be changed during the examination may appear inexpedient. Certainly it would be easier to use only one, but this would have to be considerably larger, an innovation which I consider absolutely wrong. A heavy weight means an unnecessary strain on normal eyes, and causes a depression

4.				5. Woman, 56 years.				6. Man. 75 years.			
		Cataracta.		Hypermetropi.				Glaucoma simplex.		Glaucoma Operat. Elliot.	
	mm. Hg.		mm. Hg.		mm. Hg.		mm. Hg.		mm. Hg.		mm. Hg.
5·5 / 8	11·5	5·5 / 7	13·25	5·5 / 5	18	5·5 / 5	18	—		5·5 / 5·5	16·4
—		—		7·5 / 8−	16	7·5 / 8−	16	7·5 / 1	51	7·5 / 8	15·8
10 / 13·5	9·75	10 / 12	12·3	10 / 9·5	18·25	10 / 9·25	19	10 / 3	51	10 / 11	14·5
15 / 17·5	8·9	15 / 16·5	10·5	15 / 14+	15·5	15 / 14−	15·7	15 / 7	47	15 / 13	13·3
5·5 / 9	9·9	5·5 / 8	11·5	5·5 / 6	15·2	5·5 / 6	15·2	7·5 / 1	51	5·5 / 6	15·3

in the cornea of 1 mm. or more, which is undesirable, and, as far as *my experience goes, would not increase the reliability of the* indications. My opinion is that the most reliable deflections are *those from 1 mm. to 5 mm., or at the outside 10 mm.* If a deflection smaller than 1 mm. is obtained, a heavier weight should be employed; *and if with a heavier weight the deflection is greater* than 5—6 mm., a lighter weight should be substituted.

Lastly, a heavy weight does not give exact information with

regard to eyes with normal or slightly increased pressure; it causes fluid to be pressed out of the eye, and thus reduces the pressure below its original state.

If several weights are used, the graphs should be proportioned to each other in such a manner that measurements with various weights on the same eye should yield approximately the same results. I have had a series of such measurements taken by my assistant, employing first the 5·5 grm. weight, then the 7·5 grm., 10 grm., 15 grm., and lastly the 5·5 grm. Again, the results are given in Table XII.

7. Woman 75 yrs. Cataracta incip. Both eyes.				8. Woman 32 yrs. Morb. nullus.				9. Woman 19 yrs. Morb. nullus.			
mm. Hg.		mm. Hg.		mm. Hg.		mm. Hg.		mm. Hg.		mm. Hg.	
5·5 / 5	18	5·5 / 6	15·2	5·5 / 7	13·3	5·5 / 7	13·7	5·5 / 5+	17·9	5·5 / 6·75	14·75
7·5 / 8·5	14·7	7·5 / 9·5	12·2	7·5 / 9	13·5	7·5 / 8·5	14·7	7·5 / 8	15·75	7·5 / 8·75	14
10 / 11·75	13·9	10 / 12	12·3	10 / 11	14·4	10 / 10	16·75	10 / 11−	14·6	10 / 11+	14·3
15 / 15	13·2	15 / 16·5	10·5	15 / 15	13·3	15 / 14	15·6	15 / 14·5	14·4	15 / 15	13·3
5·5 / 6·5	14·3	5·5 / 7	13·3	5·5 / 7·5	12·4	5·5 / 7	13·3	5·5 / 6	15·2	5·5 / 7	13·4

What at once strikes the observer in this Table is that the values on the whole decrease as the weights increase. This might of course indicate that the graphs for the heavier weights are too low, but when we see that the 5·5 grm. weight always indicated a lower pressure at the end of the series of measurements than at the beginning, we must conclude that fluid was pressed out of the eye by the heavier weights, and that the intra-ocular pressure was really reduced thereby, except perhaps in the glaucoma cases (Nos. 2 and 5). Allowance being made for this effect the values are so close to each other that there can hardly be any considerable error in the relation between the graphs.

These measurements show that it is inadvisable to use weights that are heavier than is absolutely necessary for the production of reliable deflections of the pointer. The pressing out of fluid when

heavy weights are used is especially evident in the case of dead eyes; it proves that the eye cannot be regarded as a completely closed organ, except perhaps in cases of glaucoma.

The conditions in a living eye are in some respects similar to those obtaining in a test-drum connected with a manometer, inasmuch as the blood pressure may be compared with such an instrument. As long as the outlets of the eye are roomy and in good working order, slight variations in pressure and influx of fluid, such as must presumably take place when the action of the heart is increased, are of no importance. Even with an increased blood pressure, normal pressure may be found in the eye.

10. Man 31 yrs.				11. Woman 36 yrs.			
Morb. nul.		Mac. corn.		Morb. nullus.			
mm. Hg.		mm. Hg.		mm. Hg.		mm. Hg.	
5·5 / 5	17·9	5·5 / 6	15·3	5·5 / 5	17·9	5·5 / 5	17·9
				7·5 / 8	16	7·5 / 8	16
10 / 10	16·9	10 / 11	14·5	10 / 10·75	16·25	10 / 10·25	16·25
15 / 13·5	17	15 / 14	15·5	15 / 14	15·5	15 / 14	15·7
5·5 / 5·5	16·7	5·5 / 7	12·8	5·5 / 7·5	12·3	5.5 / 7·5	14·3

But when the outlets grow insufficient, the fluid in the eye must be dammed up, and the intra-ocular pressure must necessarily rise. As the normal blood pressure in the central artery of the retina scarcely exceeds the normal intra-ocular pressure it would not now be sufficient to drive the blood into the eye, but as the distance between the central artery and the carotid is short, the blood pressure will increase so much that a sufficient quantity of blood will enter the eye. As the outlets of the eye grow more inefficient, the intra-ocular pressure must rise, just as when the manometer is raised, and in this manner a circulus vitiosus is established. We may assume, however, that a balance between influx and outlet may be established at any level of pressure, for a shorter or longer period.

If the pressure is driven further upwards, a point will be reached

when the intra-ocular pressure exceeds the diastolic, but is less than the systolic blood pressure. I have once seen a case in which the blood column in the central artery was flung over the edge of the papilla with each systole and disappeared during each diastole. This was before the advent of the tonometer, so that to my regret I do not know what the intraocular pressure was. At such high pressures the cornea is as a rule so dim that the interior of the eye is not visible.

If the intra-ocular pressure is still further increased, and exceeds the systolic pressure, no blood will enter the eye and the sight will be lost after a short time owing to the absolute anaemia of the retina. Such is presumably the case in the so-called glaucoma fulminans. I have not seen a genuine case of this but only one nearly similar. The sight of one eye was lost in the course of 24 hours, and that of the other was reduced in one day to counting of fingers at 1/2 m.; the pressure was $\frac{15^*}{<2}$, i.e., nearly 100 mm. Hg. The blood pressure must have been a little higher still. The patient had afterwards an iridectomy with iridencleisis, filtration, and V 6/18.

The Standardization of the Tonometer

The testing is done at the electric works of Mr. N. Jacobsen. Once in a while a sample tonometer is sent to me to be tested, and as a rule I have been satisfied with the work. To my regret I am unable to test all tonometers personally; I have therefore thought it would be of use to point out how everyone can test his own tonometer.

For the purpose of standardization eyes are not suitable. An apparatus is needed that will always give the same results when the tonometer is applied to it. Such an apparatus we have found in the metal drum covered with a thin rubber membrane as shown in the illustration on page 202.

As already said the drum has an inside diameter of exactly 14 mm. and a volume of 2-3 cubic cm. The walls are about 2 mm. thick. The upper edge over which the membrane is stretched should slope outwards a little, and the ring which is placed over the membrane must be shaped so as to fit the rim exactly. The ring is pressed down by two screws to keep the membrane in position. Below the drum there is a tap and below this a narrow neck over which the rubber tube of the manometer is slipped. This neck should not be too short as it is to be placed in a clip on a stand. Two arms turned upwards may be screwed fast to the drum, each having a notch at the upper end; the handle of the tonometer is placed in these in order to avoid holding it in the hand whilst measuring.

*This is not a fraction; it is Schiötz's method of recording a tonometer reading. 15 means that the 15 grm. weight was used; and < 2 means that the pointer stood at less than 2 on the scale.—*Editor*.

I have found the most suitable membrane to be thin sheet rubber; I chose a grey "preservative" rubber, used in women's dresses, which varies very little in thickness, and which I presume is obtainable everywhere. Its thickness may be determined by measuring two cover-glasses first with, and then without, the rubber sheet between them: That which I have used is 0.133 mm. in thickness. Fortunately a slight variation in the thickness does not seem to influence the measurement materially.

In order to exclude air bubbles the membrane may be fastened on to the drum under water, or it may be fastened first and then the drum may be filled with water by means of a syringe with a long nozzle. The drum is then connected with the rubber tube and fastened by screws to a stand, as shown in the illustration.

For measurements with open communication between drum and manometer the tonometer may be left standing in the arms already mentioned, and the deflections of the pointer may be read as the manometer is raised or lowered. It is often advisable to tap the table slightly in order to secure the correct position of the pointer. For measurements with the connection closed the tonometer must be lifted completely off the membrane before the tap is closed.

In Table XIII. I give the measurements taken on a single rubber membrane which would not sustain water pressure of over 80 cm., and also on a double rubber membrane (0·133×2) which sustained a pressure of 120 cm., the highest pressure I employed. These measurements were made on the standard tonometer; graphs may be drawn up from them and other tonometers may be tested by means of them.

TABLE XIII.

SINGLE GREY "SHIELD" RUBBER MEMBRANE, 0·133 MM. THICK.
DEFLECTIONS OF POINTER IN MM.

Pressure in cm. H_2O.	5·5 grm.		7·5 grm.		10 grm.		15 grm.	
	Open.	Closed.	Open.	Closed.	Open.	Closed.	Open.	Closed.
5	—	14	—	18·3	—	—	—	—
10	—	10	—	14·9	—	—	—	—
15	—	8	—	11·5	—	—	—	—
20	16·5	5·8	—	9·5	—	14·3	—	22
30	8	3·4	14·4	6·2	—	10·1	—	17·3
40	4·3	2	88·5	4·1	15	7·3	—	14
50	2·55	1·1	5·5	2·9	10·2	5·3	21·5	11
60	1·5	0·65	3·7	2	7·1	4	16	8·9
70	0·8	0·1	2·5	1·3	5	3	12·5	7·1
80	0·3	0	1·7	0·9	3·8	2·3	9·5	6
90	0	—	—	—	—	—	—	—

Strongly over-distended.

Before undertaking any measurements it should be ascertained that the pointer of the tonometer is correctly placed, i.e., that it points to the first line, the zero line, when placed firmly on the "model." I presume that everyone has noticed the facet or small flat area in the convex surface of the model. I have given the reason for this in an earlier article ("Tonometrie," *Arch. f. Augenheilk.*, Vol. LXII, Part iv, p. 339, 1909. Ueber die Justirung, etc.)

DOUBLE GREY "SHIELD" RUBBER 2·133 MM. THICK.
DEFLECTIONS OF POINTER IN MM.

Pressure in cm. H_2O.	5·5 grm.		7·5 grm.		10 grm.		15 grm.	
	Open.	Closed.	Open.	Closed.	Open.	Closed.	Open.	Closed.
5	—	11	—	14·5	—	—	—	—
10	—	8	—	11·5	—	—	—	—
20	14	5	21·5	7·8	—	11.5	—	17
30	6·5	3	12·1	5·3	—	8·5	—	13 5
40	3·9	2	7·5	3·7	13	6·1	—	11
50	2·3	1·2	5	2·7	8·9	4·8	18·5	9
60	1·5	0·7+	3·4	2−	6·6	3·7	14	7·2
70	0·9	0·3	2·4	1·2	4·8	2·9	10·6	6+
80	0·4	0	1·7	0 9	3·6	2+	8·5	5−
90	0+	—	1·1	0·6	2·9	1·5	7	4
100	—	—	0·7	0·25	2+	1·1	5·5	3·5
110	—	—	0·4	0	1·5	0·9	4·5	3
120	—	—	0+	—	1·1	0·5	3·8	2·6

The "model" belonging to the standard tonometer, with which all measurements for the graphs were made, was found to have a slightly longer radius of curvature than the corresponding concavity of the foot, the difference being such as to cause the index to point one millimetre beyond the zero line when an exactly fitting model was used.*

This fault, if such it be, proved advantageous, because it excluded the last millimetre of the scale. This last millimetre was a somewhat dead area, for the manometer had to be raised to a great height in order to move the pointer quite to the zero line, at least this was so when measuring on a rubber membrane.

If, on testing a tonometer any considerable differences are found between the deflections given by the tonometer and the graphs constructed from Table XIII, their importance will depend on their position on the scale. If they occur between 12 mm. and 20 mm., as often happens, they are of no consequence. In the neighbourhood

*An excellent model is found in the 30 mm. steel balls made by Nordisk Kuglelager A/S (N.K.A.), which I presume are to be had everywhere. These balls are made with such exactitude that with the ophthalmometer the same adjustment is found throughout the surface of the ball.

of 3 mm., on the contrary, they are inadmissible, for, as we have seen, deflections of 3 mm. obtained with the 5·5 grm. weight are of special importance. If an error is found in this region, an attempt may be made to correct it by a slight adjustment of the pointer, i.e., by bending it a little beyond or a little within the zero line while the tonometer rests on the model. As a rule, the error will be slight enough to allow of rectification in this way; if, however, a slight bending proves insufficient, the loose weights must be made heavier or lighter as the case may be.

The reason that the deflections between 12 and 20 mm. need not necessarily be accurate is that such deflections, when obtained with one of the heavier weights, should be rejected; even when the deflections reach to 5 or 6 mm. a lighter weight should be used. On the other hand, if deflections of more than 12 mm. occur with the 5·5 grm. weight, they fall within a part of the graph where the slope is so slight that a difference of a couple of millimetres is of no importance, *e.g.*, a deflection of 12 mm. signifies a pressure of 6 mm. Hg., and one of 14 mm. a pressure of 4·5 mm. Hg., a difference which has no practical significance.

Two New Tonometers

Finally, I desire to mention two tonometers made in America.

One is Gradle's tonometer. It is the Schiötz tonometer in every respect, but with a few "improvements" the nature of which is such that I do not consider it worth while to discuss them in detail.

The other is McLean's tonometer, a very beautiful instrument, but, to tell the truth, I cannot in this case either find any real difference between it and the Schiötz. The design and the principle are similar, though the index is made to point downwards instead of upwards. A few other slight alterations have been made, and these undoubtedly will influence the measurements, so that it will probably give results a little different from those obtained by the Schiötz tonometer.

Dr. McLean, in his lecture (Oxford Ophthalmological Congress, July 10, 1919) on "Further Experimental Studies in Intra-ocular Pressure and Tonometry," put forward the following objections to the Schiötz tonometer.

(1) The scale is placed too high; it is impossible to note the deflections, and at the same time to control the position of the tonometer on the cornea. I agree, but even with the McLean tonometer it is necessary to look at the scale, and I do not think it matters greatly whether I lift my eyes 5 cm. or 15 cm. from the foot. On the other hand, I consider it a great disadvantage in the McLean tonometer, that by reason of the position of the pointer the plunger cannot be taken out to be cleaned.

(2) One must refer to a graph for the translation of deflections into mm. Hg. It is true that the method is cumbersome, but it never occurs to me, nor, I hope, to most of my colleagues, to translate deflection values into mm. Hg. for everyday purposes. As stated above, only the weight and the deflections should be noted.

(3) The fine lines and squares on the graph schedule are difficult to read. This has nothing to do with the tonometer. Those who use the graphs very often should have them drawn out on a large scale and hung on the wall.

(4) The changing of the weights is troublesome. I do not deny that it means a little loss of time, but so far it has not happened to me that any patient has become nervous on that account. I have already given my reasons for employing several weights and will not repeat them here. The difficulty will be overcome if the new model proves satisfactory.

(5) Capillary action of fluid mounting between the plunger and the cylinder may vitiate the measurement. Such action can only take place near the lower end and only to a height of 1 mm. Higher up there is a distance of at least 0.5 mm. between the plunger and the cylinder walls, and no capillary action can take effect. I estimate the amount of fluid which might be raised by capillary force at about 0.0095 grm., a quantity which may safely be regarded as negligible. As a rule the tonometer is not used on eyes so wet that fluid is likely to be sucked up. Dr. McLean leaves an open space between the plunger and the cylinder right down to the under surface of the foot part. This may be well enough, but the reduction of the area of the foot will not fail to influence the measurements, as already shown.

McLean's tonometer subjects all eyes to the pressure of a considerable weight, viz., 25 grm., of which 12-15 grm. falls on the plunger. For most eyes this weight is unnecessarily heavy, more than 10 grm. being needed only in very rare cases.

For reasons already given, I consider it undesirable to graduate the scale in mm. Hg., as in the McLean tonometer.

That Dr. McLean found the values obtained with the McLean and Schiötz tonometers to differ considerably is due, I think, in the first place to the fact that the Hg. values for the Schiötz are too low, and, secondly, in some degree to differences in the relative weights of the various parts of the instruments and other differences. The tonometer is a very sensitive instrument, and the slightest alteration in any detail is likely to influence the deflections. For example, I have learnt recently that the lower end of the plunger in the McLean tonometer is convex. I have already shown that the shape of the plunger has an important influence on the deflections.

When the results of Dr. McLean's measurements (BRITISH

JOURNAL OF OPHTHALMOLOGY, Sept., 1919, p. 394) are drawn up graphically, the manometric pressures being placed on the ordinates and the Schiötz values in mm. Hg. on the abscissa, the 15 grm. values yield a nearly straight line, from 30 mm. Hg. up to 90 mm. Hg.; here, however, there is a leap, and then the line goes on straight from 100 mm. Hg. to 120 mm. Hg. The straightness of this line proves the instrument to be reliable. There is no better

TABLE XIV.

McLean. mm. Hg.	Schiötz. mm. Hg.		McLean. mm. Hg.	Schiötz. mm. Hg.	
18	10	$\frac{5.5}{9}$	34	21	$\frac{5.5}{4}$
20	11.5	$\frac{5.5}{8}$	43	29.7	$\frac{5.5}{2}$
20-21	13	$\frac{5.5}{7}$	42	43	$\frac{5.5}{0}$
29	15.5	$\frac{5.5}{6}$	about 52	43	$\frac{7.5}{2}$
31	16.5	$\frac{5.5}{5.5}$	65	43	$\frac{7.5}{2}$
29	18	$\frac{5.5}{5}$	70-75	62	$\frac{7.5}{0}$
30	18	$\frac{5.5}{5}$	100	86	$\frac{10}{0}$
32	18	$\frac{5.5}{5}$	110	83	$\frac{15}{3}$
33	19.5	$\frac{5.5}{4.5}$	120	90	$\frac{15}{2.5}$

test of the correct working of a tonometer than a graph. The "leap" hardly signifies a mistake, but rather some irregularity in the vitreous or the canula.

The line given by the other weights ought to have been straight, and all should unite in one straight line, but such exactitude is too much to expect. Where they are not straight the faults are not due to alteration of the weights, as that can have no influence in this respect; it must be due to inexact measurement or to irregularity in the vitreous or canula.

The 15 grm. graph appears to be too high, i.e., to give somewhat too low values. The values for the other three weights are so well mixed up with each other that their mutual position may be assumed as fairly correct.

When I had the McLean tonometer I was unfortunately so busy fitting up and moving into the clinic of our large new hospital, that I only obtained, and that mainly by the work of my assistant, a few comparative measurements. These are printed in Table XIV. The values can hardly be compared for they lie differently on the scale, but the instrument does not appear to offer any real improvement as regards reliability of measurement. The McLean tonometer is a Schiötz tonometer partly turned upside down, and as it is similar to the older instrument both in principle and in build it should measure as well, but nothing has been added which could lead us to expect it to measure better.

The aim of all tonometer workers should be to use instruments giving values which may be compared, and to agree on the principles on which such work such be based. A tonometer should be like a thermometer (Elliot), inasmuch as when applied to a test apparatus it should give invariable results.

In conclusion, I beg to express my gratitude to Mr. Priestley Smith for his exposition of the Schiötz tonometer, both in his work "On Tonometric Values," and in his letter replying to Col. Elliot's statements. I fully agree with his conclusion that "It is not proved, and it is not likely that the instrument errs to the extent that McLean's experiments suggest."

PRACTICAL SYMPATHY FOR THE BLINDED

BY

CAPTAIN FRANCIS P. PEIRSON-WEBBER.

True Appreciation

I write as a blinded man, to help the ophthalmic surgeon to have a nice appreciation of the situation from a blinded point of view, so that advice may be given with such practical sympathy that the natural despondency, which falls so heavily at the outset of blindness, may be brightened by helpful recommendations, and introductions, given with quiet assurance that carries conviction in such a manner as to create hope, desire, and determination to make the most of life, despite the handicap which exists.

Lectures in Practical Sympathy

It would be well if the Ophthalmological Society could arrange a course of lectures in Practical Sympathy, to be given throughout the year, so that the sighted friends and sympathisers of the blinded may acquire just that nice knowledge of daily difficulties which so often occur through their ignorance of the true situation. If a register could be compiled of nurses, companions, tutors, and

honorary friends so trained, the sympathetic difficulties of the ophthalmic surgeon would at once be lightened, and it would be the first step towards immediate happiness and peace of mind, which alone can meet the situation, towards success.

Patients

It will be seen at a glance that such a systematic arrangement will meet the requirements of all sorts of patients of either sex and all ages. In the case of children, the ophthalmic surgeon will be able to help them most through their parents, who must be firmly impressed with the necessity of so arranging nursery life that the child may enjoy happy independence, and quicken the intelligence, by the manner in which it is trained to appreciate the importance of sequential deductions, this being the key-note to happy independence in all things. It is of little avail to send a child to a College for the Blinded, or an up-to-date Institute, if its home-life is to be handicapped by inconsiderate difficulties that true appreciation would readily remove. In the case of older patients the initial advice must be precisely the same, and there is no apparent reason why, in many cases, the ophthalmic surgeon should not be able to arrange for one of his family or staff to be so trained, while at all times it is of the first importance that he himself should have a personal acquaintance with the system which is employed, and with those who may be registered as qualified to teach it.

The Situation

When anyone first loses sight the situation is so overwhelming, so dark, so apparently hopeless, that there is a natural tendency to discredit the practical possibilities of regaining a happy independence. Such a state of mind appears so to act upon the nervous system as to make many sufferers morbid, super-sensitive, and irritable. Consequently, it is all important that there should be no aggravation of such symptoms. Never force the situation. Encourage healthy exercise, humouring the description to meet the convenience of the occasion and the temperament of the individual.

Exercise

Nothing will bring greater peace of mind, and strength of thought, than the healthy exercise of brain and body. What more invigorating than a good swinging walk with a cheery friend of descriptive powers, so that one sees through the brain old familiar sights, thus enabling anyone to have a sequential train of thought, which not only conveys a rapid appreciation of precise locality, but also revives happy recollections of a good day's sport, or a keen desire to know the nature of crops, the condition of the river, or the

strength of the hedges, as well as their verdant beauty. For the brain craves for colour pictures, and assimilates them readily with vivid alacrity. Hack riding, tandem cycling, and team driving can all be described, if wished, but these are not for the novice. But log sawing, club swinging, dumb-bells, Sandow and Müller exercises are within the capacity of all, and usually should be associated with a cold tub to follow, or better still, a swim. Many would be surprised what a relief to the mind will be found in knitting, netting, crochet, bead stringing, and the learning of Braille, the almost universal system of raised caligraphy for the blinded.

Friendship

If it is wished to offer the hand of true friendship to the newly blinded, a letter of quiet sympathy expressing a desire to meet, and arranging a day to call, will be appreciated and looked forward to with keen desire, whereas a sudden greeting in a public place, or by chance elsewhere, will often confuse and aggravate, more especially if the greeting is one of cheery chaff that claims acquaintance off-hand, and says "Who is it?" For the mind is not yet trained to adapt itself to such rapid deduction, and failure to be normal in public, or to recognize readily the voice of an old friend, is far more difficult than might be imagined, while it hits the very seat of trouble, and conveys a feeling of helpless incapacity which is at once lost as soon as proper training and happy arrangements are made to avert such incidents.

Useful Knowledge

The ophthalmic surgeon will do well to have a useful knowledge of the blinded world, by personal acquaintance with the leading men who do so much to help forward progressive possibilities, and of such Institutes and Societies as are principally responsible for the training and education of the blinded. Of these the National Institute for the Blind, 226, Great Portland Street, London, will ever be found ready to help in a most practical manner with advice, and introductions suited to the occasion. Probably there are few sighted men who have so great a popularity, and command so thoroughly the confidence and appreciation of the blinded, as Mr. Stainsby, the Secretary-General, for his knowledge is supreme, and his sympathy so genuine and practical. At this great Institute the Braille Printing Works are a special feature, while an Information and Employment Bureau also forms part of its many vocations. In the shop department, many appliances helpful to the blinded may be purchased, including the Stainsby-Wayne Braille Writing Machine, Mr. Stainsby having given his great invention as a gift to the blinded, his name

alone being retained in memory of such generosity. Braille Instruction Books, Braille Pocket-Writers, Braille Magazines, Roman-Type Writing Frames, and a host of other things of practical interest must be seen to be fully appreciated.

The National Library for the Blind, 18, Tufton Street, Westminster, London (for ever to be associated with the life-work of the late Miss Austin and the helpful munificence of the Carnegie Trust Fund), has some 70,000 volumes in Braille type for distribution throughout the Kingdom, while other great libraries at Oxford and Cambridge still further add to the wonderful collection of books inscribed in Braille for the blinded, and may all be found in a Universal Catalogue of United Braille Libraries. Musical recitals and Shakespearean readings take place at the National Library for the Blind, while there is a reading room, with current literature in magazine and periodical form for the use of visitors who may not be subscribers to all the journals in Braille. Henshaw's Asylum for the Blind, Manchester, and the General Institute for the Blinded, Edgbaston, Birmingham, are the two principal centres of information and education for the Midlands, while Wavertree School for the Blind, Liverpool, is perhaps one of the most progressive schools for blinded children, having a strong section of blinded girl guides and boy scouts; Bradford Institute for the Blinded, Yorkshire, has some noted workshops, while the Royal Normal College for the Blinded, Upper Norwood, London, is noted for its musical training course, though other institutes are also quite remarkable in this direction.

But perhaps the most remarkable of all organizations for training the blinded may be found at St. Dunstan's, Regent's Park, London, the well-known hostel for blinded soldiers and sailors. Thanks to the resourcefulness, generosity, untiring energy, and remarkable business capacity of Sir Arthur Pearson, Bart., G.B.E., there is a ready and comprehensive training for all who may have been blinded in the great war, while an after-care system keeps trained men from drifting to failure for lack of a word of advice and help of the right sort at the right moment.

Practical Work for the Blinded

As soon as a blinded man has gained confidence in himself, the ophthalmic surgeon will do well to advise some more serious work than knitting, or netting, that may have been given at the outset, to encourage peace of mind. Most blinded men will at first resent the necessity of learning Braille, but it is only a fool who does not overcome this natural sentiment, for the delight of reading to oneself cannot be over estimated; besides, it takes many a difficult hour off the hands of our friends, for it is not altogether an easy matter to read happily to the blinded, who at times are very

captious critics. Although there are other types for touch-reading, such as "Moon" and "American Point," Braille is now universally taught.

After learning to read and write Braille, it is well to learn to write Roman-Type with a Remington Type-Machine. Nor is it so difficult as might at first be supposed, while it probably keeps one in touch with the sighted world, even more than is possible in any other way. Thanks to the generosity of the Remington Type-Writer Company, The National Institution for the Blind can arrange for a blind man to purchase his type machine at a considerably reduced price, while a Braille Shorthand Machine is also to be had, that will permit a man to take up clerical work of the greatest interest and value. In nearly all cases, the best advice is to encourage a man blinded in middle life, to continue with his old occupation, and usually this is found to be quite possible, for there are few trades that have not been successfully mastered. Blinded politicians, poets, journalists, and naturalists include the poet Milton, the politician Professor Fawcett, and M. Francois Huber, the great naturalist, who originated the observation hive for bees; while we still have with us a great journalist in Sir Arthur Pearson, successful horticulturist in Mrs. Adolphus Duncombe and Captain Towse, V.C., as well as poultry farmers, coal merchants, tea merchants, lawyers, beneficed clergymen, tutors, and many other busy workers in numerous vocations, who can always be referred to for advice, if approached the right way. At most Institution Workshops the usual trades are basket making, carpentry, shoe repairing, brush and mat making, while in some cases these trades are also worked at home, in combination with poultry keeping and gardening.

Play for the Blinded

But if the mind is to be successful at work, then it is all important that it should have relaxation and healthy change of thought, intimately associated with vigorous exercise that will stimulate the system and keep a man fit. Now the secret of acquiring proficiency in all matters of happy independence, is to acquire a habit of making rapid sequential deductions, and it will then be found that it is possible to do most things, even if one may not do them quite so rapidly as the sighted. All kinds of angling and fishing may be enjoyed by the blinded, while rowing, yacht sailing, riding, cycling, skating, rinking, dancing, and even team driving, can all be practised by a blinded man of the right sort with a happy knowledge of his subject. So far as indoor games and pursuits are concerned, we have reading, writing, cards, including whist and bridge. Chess, dominoes, draughts, the pleasure and practise of music, including every kind of instrument, as well as vocal proficiency, so as to be

able to accept engagements at concerts and entertainments. Knitting, netting, fine needlework, household duties, such as cooking, washing-up, bed-making, etc., all such occupations are a healthy change to a large number of blinded persons, who may be making some other subject their special walk in life.

Success for the Blinded

If a full success is to be achieved by any blinded man, then he must be very careful to guard against a false conceit, for the kindly sympathy of the general public may be apt to upset the true position, unless a man has seen something of the world, and can steady himself to appreciate the truth. Healthy independence is the keynote to success, intimately associated with ability, perseverance, environment, and a love for the work. Always encourage a man to take up the life for which he has the greatest inclination and place him in a position to be able easily to make good use of his powers.

May it be hoped that this short paper will to some extent help the ophthalmic surgeon to get in touch with a practical power to help his patients to happy self-reliance. Should, however, further information be required, then it is hoped that all who may wish to do so, will write to Captain Peirson-Webber, of Ettington Manor, Stratford-on-Avon.

DISEASES OF THE OPTIC NERVE AS MET WITH IN THE GOVERNMENT OPHTHALMIC HOSPITAL, MADRAS

BY

H. KIRKPATRICK,

MAJOR I.M.S.; SUPERINTENDENT, GOVERNMENT OPHTHALMIC HOSPITAL, MADRAS.

FOR the past few years it has been the custom at the Madras Ophthalmic Hospital to take notes of a routine character on most of the cases of fundus disease which come for treatment.

The first thing which must strike an ophthalmic surgeon new to the country is the very high proportion of optic nerve desease met with, especially atrophic conditions. Such disease represents nearly half the total of all fundus cases seen at this hospital.

The attached table shows that the diseases have been divided into four groups. First, those which are suffering from an active inflammatory condition associated with hyperaemia and swelling; second, those in which the inflammatory stage has passed away

but has been succeeded by atrophy of the nerve, traces of the organised inflammatory exudate being readily distinguished around the entrance of the nerve and along the walls of the larger retinal vessels. The third variety is a pure primary atrophy with no trace whatever of any previous inflammation but atrophic cupping of the nerve in its place. The fourth class is the most numerous and in some ways the most interesting. In this the nerves are atrophic, but the only signs of a previous inflammation are, in most cases, a very slight thickening of the nasal branches of the retinal artery and the fact that though the nerve is atrophic yet it shows no sign of cupping. The atrophy is evidently secondary to an inflammation which is of the mildest possible type, or which probably is mostly situated behind the globe. It is not very uncommon to find an apparently true primary atrophy in one eye and an atrophy of the above type in the other.

The special points noticed in the record are active constitutional disease, heredity, signs or history of venereal disease, blood changes, and urine abnormalities. A history of headache or headache combined with vomiting in connection with the disease was also inquired into.

The column of consanguinity of parents means that either the parents of the patient were first cousins or uncle and niece, or that such marriages were the ordinary custom in his family, although his own parents were not so related. It will be seen that there is a very high percentage of such consanguineous taint (71·8 per cent.). This is distinctly higher than that of the general population, which may be taken at about 60 per cent., but it would be rather rash to assert that it had the same bearing on the aetiology of disease of the optic nerve as it has on disease of the internal layers of the choroid and external layers of the retina. A table of diseases of the choroid and retina constructed on the same lines shows an almost identical percentage of consanguinity.

The amount of in-breeding in the South of India (and possibly in other parts of India) is extraordinary, and, even if it has no effect on diseases of the optic nerve, must inevitably produce a race degeneration. Many of the cases recorded show five and six generations of in-breeding.

Pyorrhoea was present in nearly 41 per cent. of the total, with a slightly increased ratio in cases of primary atrophy. The latter is possibly accounted for by the figures being small. This does not seem an unduly high percentage when the rate of infection of the general population is considered. Diseases of the choroid and retina show a rate of 54 per cent.

Malarial and dysenteric infections have been noted if there has been an attack within twelve months of the onset of eye symptoms. The figures are not remarkable except in the case of optic

neuritis, in which the dysentery rate is more than double that of the normal and is accompanied by a low rate of venereal infection. Two cases of neuritis came on immediately after severe dysentery and appeared to have a direct connection with the attack. One of these was syphilitic in addition. One case of atrophy secondary to neuritis appeared to have a connection with dysentery, and two came on after childbirth. The first of these had albumen in her urine, and vision was completely lost on the day the child was born. Her optic discs were greyish white and slightly swollen. The retinal vessels were much thickened, and some were partly obliterated. The second patient noticed pain in her eyes, back, and shoulders twenty days after delivery. Dimness of vision accompanied the pain, and the sight was completely lost in three days. The ophthalmoscopic picture was that of a pure atrophy, secondary to neuritis. One case of primary atrophy was a long standing one which had followed an attack of enteric 15 years before, at the age of 16. Vision was not completely lost, but reduced to finger counting near his face. One patient suffering from the fourth type of disease had been working in a chrome mine, and attributed his disease to this. Another had an attack of beri-beri just before the onset of the disease.

In view of papers by Lt.-Col. Elliot and others drawing attention to the danger of the irresponsible use of quinine, it is interesting to note that three cases of blindness due to this cause were noted during the past four years. The first of these was a man aged 30, who suffered from severe malarial fever one and a half years before coming to hospital. He treated himself with large doses of quinine for eight months, dimness of vision accompanying the treatment. When seen he could only tell the difference between light and dark. Both nerves were dead white, with clean edges. The lamina cribrosa in the right eye was visible, and that in the left obscured. There was no cupping of the nerve heads. The retinal arteries were markedly thickened. The second was a woman aged 23, who had been given a quinine injection three months previously for an attack of malaria. Her sight failed 10 minutes after the injection. Her vision was reduced to hand movements. The pupils were wide but reacted to light. All the branches of the retinal arteries were small and much thickened. The nerves were atrophic and slightly cupped, but the laminae were not apparent. The reflex was rather grey.

The third was a man aged 35 who, two years previously, had swallowed quinine by mistake for Epsom salts. He lost his sight and became unconscious. The unconsciousness lasted for 24 hours, and when he came round he found that he was blind. A short time after he began to regain his sight. The improvement continued for a year, after which the sight remained stationary. His vision was

| | | |

6/10 in each eye with a contracted field. Both nerves were waxy with slightly irregular edges. The retinal vessels were small and thickened for a considerable distance. The media were clear. There were some small spots of colloid, most numerous in the neighbourhood of the macula.

The venereal rate is high, being nearly 70 per cent. against 54 per cent. in cases of retino-choroidal disease. It is highest in the fourth class of disease, and there can be no doubt it is the most important factor in the causation of all diseases of the optic nerve seen here.

A differential leucocyte count showed, in a large number of cases, an undue increase in both mononuclears and eosinophiles. Eosinophilia is easy enough to account for, as the presence of intestinal parasites is the rule rather than the exception, but the cause of the mononuclear increase is not so clear. 23 per cent. of cases of retino-choroidal disease were found to have over 8 per cent. mononuclears.

The rate of indicanuria is unduly high for the Indian patient of the South of India, who is a rice eater, and when in good health does not commonly have any indican in his urine. I think it may be considered to be an indication of abnormal intestinal fermentation.

The high rate of increased blood-pressure found in secondary atrophy is associated with a corresponding high rate of albuminuria.

Headache was a common symptom in all varieties of the disease. Headache with vomiting, as might be expected, was most common in those in which a high intracranial pressure is not unusual.

It is to be regretted that the figures do not show any very striking facts in connection with the aetiology of the diseases, except that they accentuate the influence of syphilis. Possibly in many of the cases more than one factor is concerned. Pyorrhoea and gastro-intestinal sepsis are always with us in the tropics and are the cause of much eye disease even if they do not directly influence diseases of the optic nerve.

The figures in the series are few and only represent a small part of those seen. Many patients come to the hospital, and when they find their case is hopeless do not wait for their notes to be taken. The proportion of the different diseases is, however, about as stated.

About 65,000 out-patients attended the hospital during the period covered by the notes.

My thanks are due to the hospital staff, especially to the Registrar, Mr. Runganathan Rao, L.M.P., for their aid in making and in tabulating the notes.

PARTIAL EVULSION OF THE OPTIC DISC*

BY

W. H. SIMPSON,

SENIOR HOUSE SURGEON, ROYAL LONDON OPHTHALMIC HOSPITAL, E.C.

History.—The patient, A. S., male, aged 12 years, was struck in the right eye by a firework on June 27, 1919. On the same day he was admitted to the Royal London Ophthalmic Hospital under the care of Mr. J. Herbert Parsons.

On admission, the right eye showed a small wound of the

conjunctiva between the limbus and the outer canthus. The pupil was irregularly dilated and was tucked back on the outer side. The lens was clear and dislocated inwards. There was much vitreous haemorrhage and commotio retinae, which obscured details of the fundus. He could perceive light with the eye, projection was

* Patient shown on Nov. 5, 1919, before the Section of Ophthalmology of the Royal Society of Medicine.

defective down and in, and the tension was subnormal. The left eye was normal with a vision of 6/6. The patient was kept in bed for three weeks, atropin being instilled in the right eye.

On July 23, the vitreous had partially cleared and there was no commotio retinae. The retina was seen to be in position, but the disc was obscured by an unusual appearance, details of which, owing to the state of the vitreous, could not be made out till August 2, when a good view was obtained. The disc was then seen to be included in a horizontally oval ectatic area bounded internally by the disc margin and extending outwards towards the macula. The area presented a much paler reflex than the rest of the fundus and was sharply defined, except below, by superficial retinal pigmentation. Round the macula there was dense pigmentation and between the disc and macula there was pigmentation and some cicatricial tissue formation. The retinal vessels, on entering the area, showed a decided bend similar to that seen in early glaucomatous cupping and, once in the ectasia, they were out of focus. The walls of the ectasia were steep at the disc, above and below, but towards the macula the slope was more gradual. The ectasia was rather too shallow for accurate measurement; the disc was the deepest part and vessels there were brought into focus by minus two dioptres. Below the area there was much retinal degeneration, and at the periphery the only abnormality was guttate pigmentation.

The patient could count fingers at six inches, projection was defective down and in, and the tension was subnormal.

INTRA-OCULAR HAEMORRHAGE AFTER GUTHRIE'S SECTION

BY

ALAN W. SICHEL, M.D.

RESIDENT SURGICAL OFFICER, BIRMINGHAM AND MIDLAND EYE HOSPITAL.

THE three cases recorded below are of interest as illustrating an unusual complication following the performance of Saemisch's, or, more correctly, Guthrie's section for corneal ulcer.

CASE I.—H. G., aet. 52, was admitted to the Birmingham and Midland Eye Hospital on November 14, 1919, suffering from a hypopyon ulcer of the left eye. There was no history of injury. The eye had been affected for eight weeks. Guthrie's section was performed under cocain on the evening of admission. At the first dressing on the following day the condition of the eye was satisfactory. About two hours later the patient complained of pain, and on the dressing being removed the lens in its capsule was found adhering to the pad. The dressing was reapplied. About one hour later further pain was complained of, and on removing the pad vitreous was seen to be protruding through the gaping corneal wound. The eye was eviscerated the same afternoon. On

removal of the vitreous large masses of dark blood clot came away.

The records of this case further show: R.V. 6/6. Fundus normal. R. tension, on digital examination, normal. Blood pressure, maximum systolic at radial, 132 mm. Hg.

CASE II.—C. C., aet. 54, was admitted to the Birmingham and Midland Eye Hospital on January 4, 1920, with a hypopyon ulcer of the left eye following an injury by the twig of a hedge two weeks previously. Guthrie's section was performed under cocain on the following day. The eye was dressed twice daily on the first two days after operation and the condition found to be satisfactory. On the 7th inst., viz., three days after operation, the wound was found to be bulging and the lens in its capsule came away on the dressing followed by vitreous. Evisceration was carried out the same day.

Unfortunately no record was kept of blood pressure or tension, but the case sheet shows: R.V. 6/9, fundus normal.

CASE III.—W. M., aet. 44, was admitted to the Birmingham and Midland Eye Hospital on January 9, 1920, suffering from an extensive ulcer of the right cornea unaccompanied by hypopyon. The eye had been injured ten years previously, and on admission was divergent, with vision reduced to hand movements, and tension much raised. On January 13, progress not being satisfactory, Guthrie's section was performed under cocain. The condition of the eye remained satisfactory until the 15th inst., viz., two days after operation, when, about 5 p.m., the lens intact in its capsule was found on the dressing. The patient was seen at 8 p.m. and stated that he was quite comfortable. Five minutes later very intense pain was complained of, followed in half an hour by a severe expulsive haemorrhage. The eye was enucleated the same night. On section after removal, there was found complete detachment of the retina, the whole vitreous chamber being filled with blood; the optic disc was markedly cupped.

The condition of the left eye was as follows: V. 6/6; fundus normal; tension, by Schiötz tonometer, 26 mm. Hg. The maximum systolic blood pressure at the radial was 180 mm. Hg.

The operation in each case was performed in the usual manner, a Graefe knife transfixing the eye from clear cornea to clear cornea on either side of the ulcer and coming out through the base of the latter. The incision extended almost the entire width of the cornea in its horizontal diameter. The lenses were not injured at the time of operation, as witnessed by the fact that in each case they were found intact in their capsules after extrusion.

It is stated by Török and Grout[1] that the lens and vitreous may escape at the time of operation when performed under cocain if the patient should squeeze, but the perusal of an extensive literature reveals no record of such a complication occurring as late as two to three days after operation.

In Case III the sudden lowering of a raised tension may account for the occurrence of intra-ocular haemorrhage, but this cannot apply to Cases I and II unless there were antecedent vascular degenerative changes in the retinal or choroidal vessels of which there is no evidence.

It has been thought worth while to record the occurrence of this unusual complication in view of the fact that Guthrie's section is an operation resorted to not infrequently in cases of hypopyon keratitis.

My thanks are due to Mr. Jameson Evans, Mr. Fulford Eales, and Mr. Harrison Butler for permission to publish the notes of these cases.

REFERENCE

(1) Török and Grout.—Surgery of the Eye, p 136.

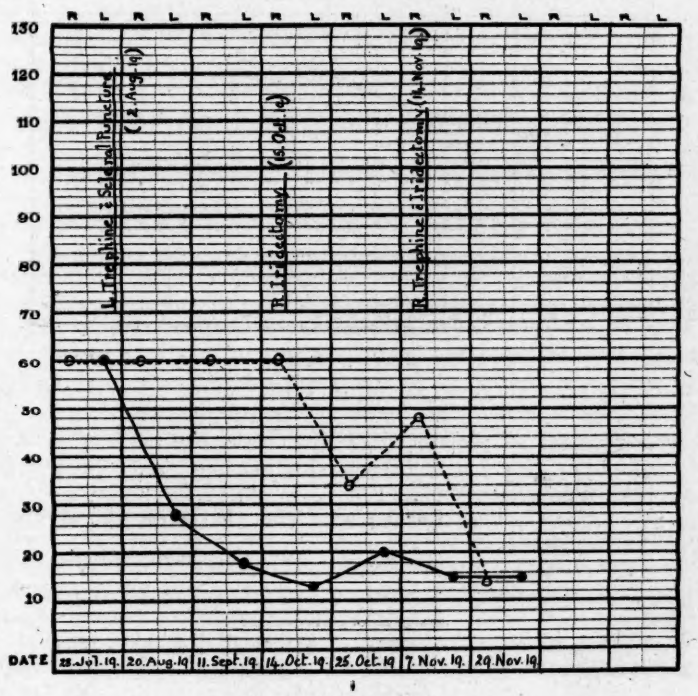
A TONOMETRIC CHART

BY

T. HARRISON BUTLER,

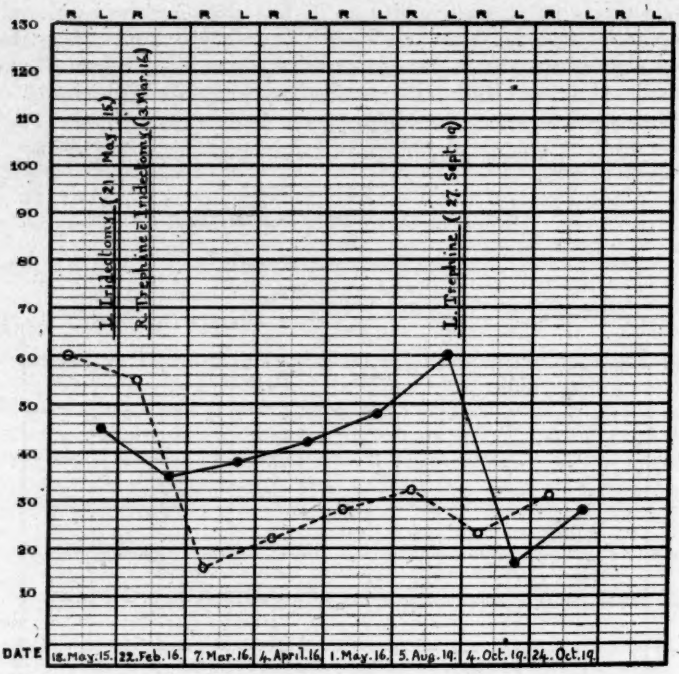
LEAMINGTON SPA.

CONSIDERABLE time may be wasted in hospital work when a case



Charles D., aet. 65.

of glaucoma turns up after some lapse of time. To get a grip of the progress of the disease all the back notes must be read, and the Schiötz readings considered. It struck me that it would be useful to have all the tonometric readings plotted upon a chart. The enclosed graph was made for me by Messrs. Charlton & Co., of Birmingham, and I have had it in constant use for some months. I



Albert R., aet 54.

find that it effects a great saving of time. Mere inspection shows the progress of the case and the effect of any operation which has been performed. I plot the right eye tensions in red ink, the left in black. For the purpose of reproduction the right tension has been plotted in broken line. I have to thank my house surgeon, Mr. Sichel, for drawing the curves. The charts may be obtained from Messrs. Weiss.

THE USE OF MAGNESIUM SULPHATE AS A LOCAL APPLICATION IN INFLAMMATION OF THE CONJUNCTIVA AND CORNEA

BY

H. KIRKPATRICK,

MAJOR I.M.S.; SUPERINTENDENT, GOVERNMENT OPHTHALMIC HOSPITAL, MADRAS.

SINCE the time when the value of induction of osmosis and lymph flow by the use of hypertonic solutions was recognized in the treatment of war wounds, magnesium sulphate solutions have been in constant use at the Madras Government Ophthalmic Hospital in the treatment of inflammatory conditions of the conjunctiva and surface of the cornea, and over four years' experience have fully convinced me of its great value as a remedy in such diseases.

In the majority of suppurative ulcerations of the cornea the pain is relieved and the surface cleaned in a striking manner, though it must be confessed that it does not act with an equal degree of success in all cases, possibly owing to a lower antitoxic and bactericidal lymph value in such patients. It can be claimed, however, that in most cases the ulcer heals with less pain and less scarring as a result of its use. It is the custom to administer 15 grains of urotropin every three hours with, of course, atropin locally, and under such treatment it is only rarely found necessary to cauterize the ulcer or perform a paracentesis. A bandage is not generally used.

Eyes suffering from trachoma with a secondary infection are not uncommonly met with, and these generally respond to the magnesium sulphate treatment in a very gratifying way. It is, however, in gonorrhoeal ophthalmia, with its associated chemotic condition, that the treatment has its most marked success, and, as far as I am aware, no eye which was in a reasonable condition when first seen has been lost from this disease since our present routine treatment was adopted.

The action of magnesium sulphate in all chemotic conditions has been found most satisfactory, and even in suppurative panophthalmitis it will often reduce the swelling of the tissues, free the patient from pain, and sometimes allow him to keep his eyeball—a very important matter in a country where an artificial eye is unlikely to be worn or be properly cared for if obtained.

The strength of the solution used varies from 40 grains to the ounce to saturation, and this is applied in an eye bath for five minutes every two or three hours; in addition, the conjunctival sac is thoroughly irrigated by the surgeon once a day or oftener. In cases of gonorrhoeal ophthalmia both urotropin and stock gonococcal vaccines are given as well.

It is possible that hypertonic solutions are already extensively used in the manner described, but I have seen no reference to them in any literature to which I have access.

SPONTANEOUS RUPTURE OF THE GLAUCOMATOUS EYE: AN ILLUSTRATIVE CASE

BY

CAPTAIN W. J. RUTHERFORD, M.C., M.D. (Glasg.),

LATE R.A.M.C.

IT must be rare for a glaucomatous eye to come under observation at the moment of rupture or immediately afterwards, and any record of the symptoms is therefore of value as tending towards a fuller knowledge of all phases of this condition. The only reference available to me is that of the case of spontaneous rupture of the cornea in secondary glaucoma due to dislocation of the lens, shewn by Mr. N. Bishop Harman[1] at a meeting of the Section of Ophthalmology of the Royal Society of Medicine on February 3, 1915:

"An injury caused total dislocation of one lens into the posterior "chamber, where it was loose. The resulting glaucoma was "absolute, and vision was lost. The cornea was anæsthetic, the "iris quite retracted and immobile. The condition remained for "two years without ulceration of cornea or splitting of Descemet's "membrane. Three months later, however, without any further "accident, the cornea was split horizontally, and the membranes "were prolapsed. The cause of the rupture was a retro-choroidal "haemorrhage."

Some years ago I was called out hurriedly one Sunday evening to see a woman whom I found semi-maudlin from fright, and sitting up half naked on a dirty bed in a single apartment slum dwelling, which was crowded with interested spectators. A thin stream of blood was trickling down her cheek, coming from the right eye, from which vitreous and part of the iris were prolapsing through a central rupture in the cornea, the softened remains of which were of an opaque bluish-white colour. No sign of the lens was noticed. By the side of the bed there was a large zinc pail holding, perhaps, half a gallon or more of clear watery fluid, which, it was claimed, she had vomited.

The room was at once cleared, and she was given $\frac{1}{4}$ grain of morphin by the mouth. As this was vomited, it was repeated in an hour (when it was found to soothe the pain and check the vomiting), but, in the meantime, she was made to lie down in bed and was warmly wrapped up in borrowed blankets, a hot bottle being put to her feet. No attempt was made to cleanse the part, but a pad was applied over the closed lids and held in place with a bandage.

The story obtained was somewhat as follows. She was a travelling pauper, and was in the habit of going about from place

to place wheeling in a chair her husband, a cripple, who gained his living by playing a fiddle in the streets. Five years before, her right eye was injured with a splinter of glass from a broken bottle; it subsequently became blind, as the result, no doubt, of chronic glaucoma, and she began to be subject to severe, but intermittent, headaches, worse especially in the right supraorbital region, which had, however, by no means a monopoly of the pain. For these headaches nothing was done, and, in spite of them, she continued her peregrinations of the country-side.

The day before her eyeball burst, the headache became especially severe. It continued overnight, and next day she felt too ill to get up from bed or take any food. At about 6 p.m., the headache never having left her meanwhile, the cornea suddenly gave way, to her great alarm, the eye discharging first a little jet of watery fluid (which must obviously have been the aqueous under tension) and then a steady trickle of blood. At the instant of rupture (which was spontaneous, and not caused by vomiting[2] or coughing, etc.), there was a great accession of pain over the forehead, and she at once began to vomit without effort, and in sudden gushes copious quantities of clear watery material, which was not bile-stained or mixed with food, as she had been fasting all day. Curiously enough, she presented no evidence of shock when seen very shortly afterwards, although the vomiting was continuing to a certain extent, and was still not merely sudden but actually violently expulsive whenever it occurred.

Arrangements were at once made to have her admitted to the nearest hospital, to have the ruptured eye enucleated. She refused to go that night, but went without any difficulty the next morning. A few days afterwards I tried to communicate with the surgeon in charge. As he was not at home I rang up the hospital—which had no house surgeon—to inquire how the woman was, but was refused all information.

The amount of haemorrhage in this case was very slight, probably less than a fluid drachm altogether; it ceased entirely on the administration of the second dose of morphin, and did not recur. The profuse haemorrhage stated to occur in rupture of a glaucomatous eye,[3] and such as is significant of any rupture of the globe,[4] was only conspicuous by entire absence. Accompanying the pain of acute congestive glaucoma vomiting is a well-recognized event, and in connection with the disturbances of intraocular pressure produced by the operative procedures incidental to extraction of the lens it sometimes occurs, but is never, apparently, anything like so copious and free as it was in this case. The probability is that it was due to an acute gastric dilatation, a condition of some danger, the prompt recovery from which was a most fortunate event. It is of interest to remember that a very considerable proportion of the

recorded cases of this condition (acute dilatation) have followed either upon some injury or else an operative procedure.

REFERENCES

1. "Reports of Societies," *Brit. Med. Jour.*, Feb. 13, 1915, p. 290.
2. "Among the older writers we find Ficker" (*Journal der praktischen Arzneykunde und Wundarzneykunde*, 1809, Vol. XI, p. 63), and the Ephimerides giving instances of exophthalmos from vomiting. Fabricius Hildanus *Opera omnia*, 1646, cent. I, obs. I) mentions a similar instance. Gould and Pyle, *Curiosities and Anomalies of Medicine*, 1901, p. 527.
3. Priestley Smith in Norris and Oliver's *System of Diseases of the Eye*, Vol. III, 1897, p. 670.
4. Gruening, *l.c.*, p. 694. "Rupture of the Cornea is so exceeding rare, if it occur at all, that it may be left out of consideration." Beaumont, *Injuries of the Eyes*, 1907, p. 71.

OPHTHALMOLOGICAL SOCIETY CONGRESS, 1920

THE Eighth Annual Congress of the Ophthalmological Society of the United Kingdom was held on April 29, 30, and May 1, 1920, under the Chairmanship of the President, Mr. John B. Story, P.R.C.S. Ireland. The morning of the first day was devoted to papers, as is customary. The President gave a short address in which he strongly advocated that before a student's name is placed on the Medical Register as a qualified practitioner, evidence of at least three months' instruction in the eye department must be presented, and the candidate must undergo a practical examination, conducted by two or more ophthalmic surgeons. Mr. C. H. Usher described the eyes of some goldfish with enlarged corneae, and showed the specimens on which his paper was based; as an addendum to this paper, Mr. Treacher Collins dealt with cases of megalocornea and of microcornea. A paper by Dr. John Rowan, entitled, "Are not some cases of glaucoma better treated without operation, and, if so, what are the indications?" produced, as might be expected, a considerable amount of discussion. This is a thorny subject; while the younger school insisted on the value of the tonometer, Mr. Richardson Cross sturdily upheld the "tactus eruditus," the educated finger, and the state of the visual field, while Mr. Treacher Collins spoke of the age and general condition of the patient. Mr. Zorab read notes on his later results of aqueoplasty, and his cases illustrating this operation were on view at the clinical meeting later in the day. The last paper read was one by Mr. Harrison Butler on the subject of post-operative infection in cases of cataract. It was unfortunate that time did not allow of more than a very limited discussion of this practical subject.

Papers by Messrs. Pooley, Goldsmith and Alexander, which were placed on the programme, were taken as read, and will appear in the *Transactions*. The clinical meeting was held at the Royal London Ophthalmic Hospital during the afternoon; numerous interesting cases were shown, while the Curator of the museum of the Hospital had been at great pains to arrange an exhibition of the treasures of the library and of the museum, notably the original drawings of John Dalrymple's famous "Pathology of the Eye." Sir William Lister showed the really beautiful collection of War injuries of the eye, which is housed at the hospital by permission of the R.A.M.C. War Museum Authorities, as well as some fine stereoscopic photographs of the specimens.

At 4 p.m. members crowded into the Lecture Theatre to hear Mr. Percy Flemming on the subject of the topography of Moorfields. His paper was illustrated by lantern slides and maps of old London. A punning bard wrote in the previous century,

"Moorfields are fields no more";

but Mr. Flemming carried our minds back to Roman London, spoke of the Wall, the Archery Ground, the Tenter Ground, the Windmills, "Old Bedlam close by London Wall," and the perilous pool in which the Blue Coat Boys used to bathe, now evidenced by the modern Peerless Street, in which is the entrance to the Hospital for out-patients. Quotations from the diaries of Pepys and of Evelyn were read. At the conclusion a very hearty vote of thanks was passed to Mr. Flemming for his very interesting address. The author of it has by no means exhausted the store of antiquarian interest of the neighbourhood, and we hope that when next the clinical meeting is held at "Moorfields," he will give us another demonstration on Bunhill Fields, John Wesley, Edward I., the Finsbury Archers, etc., for there is no doubt that such lectures add greatly to the interest of the Congress.

The dinner of the Society was held at the Imperial Restaurant in the evening. The President proposed the toast of the Society, to which responded Mr. Treacher Collins, the past President, and Mr. J. Herbert Fisher, the future President. Mr. Richardson Cross proposed the health of the President, and Mr. Story responded in a speech full of humour and feeling. The toast of the Visitors, Sir Archibald Garrod, General Sir E. G. Barrow, G.C.B., and Surgeon-General Sir R. Havelock Charles, G.C.V.O., was proposed by Mr. J. B. Lawford, and replied to by Sir Archibald Garrod, while the Treasurer of the Society, Mr. Arnold Lawson, gave the health of the Secretaries, who replied.

The morning of the second day was given up to a discussion on Diabetes in relation to Diseases of the Eye, opened by Sir Archibald Garrod and by Mr. Foster Moore. The Regius Professor of Medicine in the University of Oxford dealt principally with the

forms of retinitis met with in the disease, and spoke of the modern "fasting" treatment of the general condition; Mr. Foster Moore spoke on the surgical aspects, and covered the ground admirably, dealing with cataract, retinitis, lipaemia, retro-bulbar neuritis, ophthalmoplegia, and differences in refraction. The discussion was carried on by Drs. Leyton, Cammidge, Poynton, and Hawthorne, from the medical side, while Messrs. Mackay, Adams, Gray Clegg, James, Bardsley, Stack, Harrison Butler, and Burdon-Cooper spoke on the surgical side. We are convinced that those who were present came away with much enlarged views on this subject.

The business meeting of the Society was held in the afternoon.

The Report of the Council and the Treasurer's statement were adopted, and it was decided to raise the annual subscription from one guinea to 31s. 6d. from October next, and to inaugurate a reserve fund for illustrating the *Transactions*. The officers for the Session 1920-1921 were elected as follows: President, Mr. J. Herbert Fisher. Vice-Presidents, Messrs. Story, Treacher Collins, Sym, and Sir William Lister. Treasurer, Mr. Arnold Lawson. Council, Messrs. Kinnier Wilson, Cridland, Gray Clegg, Mayou, A. R. Brailey, and Goulden. Secretaries, Messrs. James and F. A. Juler.

In the evening several important papers were presented. Mr. Traquair described a case of anatomically separate anterior commissure at the chiasma, in an acromegalic with pituitary tumour. He showed slides and the specimen. Dr. Gordon Holmes read a paper on four cases of tumours involving the optic nerves and chiasma. As Dr. James Taylor said in the discussion which followed this paper, Dr. Gordon Holmes's cases had definitely enlarged our knowledge of these cases. Mr. Hine described a case of primary epithelial tumour of the ciliary body and showed slides and pictures of the same. Mr. Ernest Clarke read further notes on the Accommodation of the Eye, and showed two more tables, constructed from his practice, in which his "minimal" line practically coincided with Donders' "mean" line. Mr. Neame read an elaborate paper on retinal cysts, and Mr. Wallace one on a glyptic method of representing certain conditions of the fundus in disease. Time did not permit of reading the paper of Mr. A. W. Stirling on melanoma of the iris, with Mr. Collins's pathological report, but this communication from the United States will also appear in the *Transactions*.

On the morning of the final day, members visited the St. Margaret Hospital, the special hospital of the Metropolitan Asylums Board for cases of ophthalmia neonatorum. They were shown over the building by Mr. Mayou, and a discussion on the prevention and treatment of the condition was held afterwards. This was opened by the Master of the Rotunda Hospital, Dr. Gibbon Fitzgibbon, and

by Mr. Mayou. Other speakers included Mrs. Scharlieb, Dr. Macrory, Messrs. Sydney Stephenson, Maitland Ramsay, John Wharton, A. L. Whitehead, Thomas Stevenson, Killick, and J. B. Lawford. From the point of view of State welfare, this was a most important piece of work, and we owe a debt of gratitude to those who opened and took part in the discussion. In passing a vote of thanks to the Metropolitan Asylums Board for their permission to visit St. Margaret's Hospital, the members of the Society expressed the wish to urge on the Board, now that so large a number of cases of ophthalmia neonatorum are assembled together in one institution, that facilities should be afforded at their hospital for the instruction of medical students, midwives, and district nurses in the natural history and treatment of the disease.

ANNOTATIONS

The Pathogenesis of Detachment of the Retina

The pathogenesis of spontaneous or so-called idiopathic detachment of the retina has been the subject of many investigations, clinical and pathological. Indeed, if obscurity of causation can be gauged by the amount of literature, detachment of the retina occupies a high position in the scale of undetermined pathogeneses. The most recent observations are contained in an elaborate report presented to the Société française d'Ophtalmologie, last month, by Dr. Gonin (Lausanne), who was the opener of a discussion on the "Pathogenesis and Pathological Anatomy of Retinal Detachment (exclusive of that due to trauma, tumours, and parasites)." The views expressed therein recognize three pathological conditions as the chief causal agents of detachment, but their importance as determining factors is unequal. These three conditions are (1) distension of the globe, such as occurs in myopia and in hydrophthalmia, (2) traction on the retina from within, and (3) subretinal exudation. Distension of the eyeball exerts less influence on the retina itself than on the anatomical relation of the vitreous body to the retina, and on the integrity of the uveal tract; it induces nutritional changes which predispose to detachment, but does not alone give rise to it.

Traction on the retina is the determining factor in the causation of idiopathic detachment; in this process the chief rôle appertains to the vitreous body, but the altered conditions of this structure are themselves due to pathological changes originating in the uveal tract. Spontaneous detachment, therefore, cannot be regarded as a lesion affecting the retina alone, to the exclusion of other ocular

tunics. This is true, also, of other non-traumatic forms of detachment. Exudation, as a causal agent, is derived from the choroid, or occurs as a serous effusion from the retina, and is the direct cause of detachment in the retinitis of albuminuria, etc. When present in idiopathic detachment such exudation plays a purely secondary part.

No real progress in the treatment of this affection, so serious and hitherto so intractable, can be hoped for unless a genuine attempt is made to determine the pathogenesis in every case. While it is true that in many instances this is extremely difficult, it is equally true that not infrequently a thorough clinical examination affords a clue to the cause of the detachment and a guide to the measures to be advised.

Ophthalmia Neonatorum

The discussion on the prevention and treatment of ophthalmia neonatorum, which took place at the recent congress of the Ophthalmological Society of the United Kingdom, has brought into prominence once again the greatest cause of preventible blindness. Much has been done in this country to mitigate the scourge, as witness the notification of the disease, the registration of midwives, the provision of health visitors, and last, but not least, the opening in some cities, as Manchester, Liverpool, Glasgow, and London, of hospitals for the reception of affected babies and their mothers. But more is called for, and that can only be met by the adoption of prophylaxis in all cases of childbirth. The precise means adopted may differ, nor does that matter, always provided they are efficient. In the upper classes, where gonorrhoea is relatively rare, some simple means, such as that suggested by Samuel Hague in 1879 (*Brit. Med. Jour.*, June 21, 1879, p. 959), who wiped away every trace of moisture from the baby's eyelids the moment the head was born, together with the careful washing of the baby's hands and arms, would probably suffice. In institutions where women are delivered at the cost of the community, when gonorrhoea is present in the mother, when there is a history of inflamed eyes in former babies, and in the lower classes generally, probably the best preventive is by the instillation into each eye of a single drop of 1 per cent. solution of silver nitrate. Credé, it will be recalled, employed 2 per cent. silver nitrate, and the efficacy of his method has furnished its proofs long ago. At the same time the plan is not altogether free from objections. Even when most carefully applied, it does not prevent all cases of ophthalmia. It is clearly powerless to prevent ante partum or post partum infection. Its use is nearly always followed by reaction on the part of the conjunctiva, as shown by

discharge and redness. Certain figures show that the 1 per cent. solution is fully as protective as the 2 per cent. solution. For example, in 76,452 infants treated by Credé's plan the percentage of ophthalmia was 0·703, while in 18,393 infants whose eyes were were treated with a 1 per cent. solution the percentage of ophthalmia was 0·628. In conclusion, the fact must be insisted upon that whatever method of prophylaxis be employed, whether aseptic or antiseptic, precautions against infection of the baby's eyes must be maintained throughout the whole period of lying-in.

ABSTRACTS

I.—LATENT NYSTAGMUS

van der Hoeve, J. (Groningen, Holland).—Latent nystagmus. *Arch. d'Ophtal*, Dec., 1917, and *Nederl. Tijdschrift voor Geneeskunde*, 1918, I, No. 12, p. 730.

van der Hoeve records eight cases of latent nystagmus. With both eyes open, the eyes were steady, but on covering one eye horizontal nystagmus appeared instantaneously, which diminished the vision to respectively 1/7, 1/5, 1/5, 1/3, 2/7, 1/2, and 2/3 of the vision with both eyes. When both eyes were closed, they were steady; if one eye was closed and the open eye was fixed with fingers or a forceps, so that no movement was possible, the vision was as good as with both eyes. The movements are, therefore, the cause of the diminished vision.

Four of the cases showed strabismus, one latent strabismus, the other three had no strabismus at all; the field of fixation was normal in all cases. Five patients had chorio-retinitis, only one had quite normal eyes. Ears and static organs were exactly tested. Labyrinth diseases, syphilis, or nerve diseases were not found in considerable amount.

Wehrli's explication of latent nystagmus, as caused by insufficiency of the eye muscles, is rejected for these cases. All patients showed spring nystagmus with the fast phase to the side of the fixing eye.

van der Hoeve agrees with Fromaget that the tonic centre of the associated eye movements is the final aim of numerous centripetal impressions, auditory, optical, psychical, general, etc., and that all these excitations give a tonus in that centre which governs the balance of the eye movements. In normal individuals the balance is so stable that one or other of these excitations can be diminished

without complications; in patients suffering from latent nystagmus, on the contrary, the balance is so labile that diminishing of the optical excitations by covering of one eye is enough to abolish the balance of the eyes.

van der Hoeve thinks that just as every labyrinth gives an excitation which tries to deviate eyes to one side, the retina gives the centres of the associated eye movements excitations in a way that the left retina tries to deviate the eyes to the right side, the right retina to the left side.

In normal people exclusion of one eye causes no deviation; in patients with latent nystagmus exclusion of the right eye causes deviation of the eyes to the right side, because only the left retina gives its excitation to the centres. This deviation is the slow phase of the nystagmus, the fixation turns the eyes back to the normal position (rapid phase of the nystagmus). Neither the deviation force nor the fixation force is strong enough to hold the eyes in one position, deviation and returning alternate, and thus cause the nystagmus.

Many of the patients have no nystagmus when the head is turned so that the fixing eye stands in the inner canthus. This fact is easily explained; when the right eye is closed, and the head is turned to the left, the fixation will turn the eyes to the right side, the deviation goes also to the right; both forces bring the eyes to the right side, there is no force which turns them back, therefore the left eye stands steady in the inner corner. Wehrli saw the same with one of his patients, who could fix very well with one eye, when he turned his head so that the fixing eye stood in the inner corner.

Wehrli explains this by muscle insufficiency, though no limitation of movements could be found out. If, on the contrary, the head is turned so that the fixing eye is placed in the outer corner, excessive nystagmus may appear, because the deviation turns the fixing eye to the inner corner, the fixation to the outer, with the result, when both forces are strong, a fast nystagmus with big excursions; if the deviation force is weak, then the fixation force will overtake the eye before it reaches the inner corner and a feeble nystagmus with small excursions appears as the eye only moves in the outer half of the fissura palpebralis. If the fixation force is weak, then a feeble nystagmus will appear with movements only in the inner half of the fissura palpebralis.

These hypotheses explain also the fact that the nystagmus may be most marked, just as much when the better as when the worst eye is excluded.

The two hypotheses, viz., the primary anomaly in patients with latent nystagmus is (*a*) labile balance of the associated eye movements; (*b*) the retina of an eye has influence on those centres which

try to deviate the eyes to the side opposite to the fixing eye, explain all the recognized symptoms of latent nystagmus.

Several of the patients had also a feeble manifest nystagmus; two of them changed their nystagmus from manifest into latent. It is not necessary for the appearance of the nystagmus that the eye should be closed; spherical, cylindrical, London smoke glasses, etc., give, when placed before one eye, nystagmus, if they make the vision of that eye indistinct. Prisms, on the other hand, are tolerated in a high degree; it seems that it is more necessary for the tranquillity of the eyes that the image should be distinct, than that it should fall on the macula lutea.

In opposition to Fromaget, van der Hoeve does not believe that the loss of one eye means for these patients permanent incurable nystagmus. Nystagmus as a rule can be compensated. When in rabbits one labyrynth is destroyed, a very marked nystagmus appears; but after some time, this is so completely compensated, that though destruction of both labyrynths causes no nystagmus, now the destruction of the second labyrynth gives nystagmus, just as marked as if the first labyrynth was quite normal. In analogy of this complete compensation, van der Hoeve expects that patients suffering from latent nystagmus will recover after losing one eye; perhaps they can help themselves by turning their head to the side of the remaining eye.

The anomaly is not a rare one, as the publications of Graefe, Fromaget, Wehrli, Dorff, and van der Hoeve prove. Patients with latent nystagmus may not enter the military, railway, or navigation service. VAN DER HOEVE.

Jacobs, Max W. (St. Louis).—Latent nystagmus. *Amer. Jl. of Ophthal.*, Series 3, Vol. I, No. 3, March, 1918.

Jacobs states that during the past forty-five years occasional cases of nystagmus have been reported which are characterized by the fact that the essential eye phenomenon appears only when one eye is covered, or binocular vision interfered with. Whatever the cause may be, the reviewer believes that the cases are really much more common than the above statement would indicate, for he has himself seen quite an appreciable number of such cases, and doubtless others have done the same. As to the cause, which is very obscure, one cannot do better than transcribe the author's words: "As Dorff has stated, it is assumed to-day that there is a supranuclear tonic centre which controls the ocular movements associated with binocular seeing. The centre must be connected with the cortex, cerebellum, vestibular apparatus and nuclei of the eye muscles. Coppez, one of the investigators along this line, assumes that there is a rhythmic or clonic centre from which arise nystagmic movements. This clonic centre is ordinarily controlled

by the tonic centre. In my patient, as in the first case described by Dorff, no peripheral cause for the disturbance in equilibrium could be found; and I believe we can assume that we are dealing with an under-developed tonic association centre which does not sufficiently inhibit the clonic centre."

The reviewer may perhaps be excused for obtruding the suggestion which the reading of Jacobs' article has brought to his mind, that undetected latent nystagmus might account for at least a proportion of those cases in which no amount of perseverance on the part of the oculist results in the expected improvement of the vision by glasses so long as each eye is tried separately, but in which an immediate response is obtained by correcting both eyes together. ERNEST THOMSON.

II.—EVULSION OF OPTIC NERVE

Blake, Captain Eugene M. (Newhaven, Conn.)—A case of evulsion of the optic nerve. *Trans. Amer. Ophthal. Soc.*, Vol. XVI (1918), p. 82.

To judge from the paucity of references in the literature, evulsion of the optic nerve is a rare condition. But it is probable that in severe head injuries, such as may occur in automobile accidents, train wrecks, and so on, a more careful examination of the fundi or of the enucleated eye would show the condition to be less uncommon than now appears to be the case. It may be produced by the entrance into the orbit of foreign bodies, such as sharp sticks, pieces of metal, stone, or shot, or by the application of a crushing force driving the eyeball forward and over-extending the optic nerve until it is pulled out of the scleral opening. The case reported by **Blake**, outlined below, is a good example of the last method of causation. The patient, a man aged 29 years, while driving a waggon, collided with a milk team, and was thrown to the ground, his head striking a trolley track and his waggon falling on top of him. L.E. enucleated on admission to hospital shortly after the accident. R.E. lids swollen and ecchymosed; marked conjunctival haemorrhage. Pupil slightly dilated, and did not react to light. No P.L. Nose compressed and deviated to left side. "Can insert fingers into antra." Fractured maxillae. Wounds of scalp, face, and mucous membrane of mouth. Fracture-dislocation left clavicle and fracture of third rib. The fundus was examined for the first time one week after the accident. The region of the papilla was occupied by an excavation, of a depth of at least 8 D. In colour it was uniformly grey, and conveyed the

impression of looking into a deep well. The diameter of the hole was slightly greater than that of the normal disc. The retina was torn on the nasal side of the opening and separated from the choroid for a short distance. There were haemorrhages in the fundus. The greater number of the retinal vessels were white and bloodless; veins and arteries could be differentiated with difficulty. In the course of a few weeks the excavation was filled in with new-formed connective tissue, the haemorrhages were absorbed, and the circulation was restored in several of the vessels in the lower part of the retina. Sight, however, was not recovered. The man was later transferred to the State Asylum for the Blind.

The nature of the injuries found upon entrance to hospital affords an explanation of the mechanism of production of the evulsion of the optic nerve. The patient fell upon his head in such a way that the force of the blow was directed upwards and to the left, and this accounts for the fracture and separation of the superior maxillae and nasal bones and the extrusion of the left eye from the orbit as evidenced by the position of the wounds. Enough pressure was disseminated to the right to produce sufficient protrusion of the right eye to separate the optic nerve from the globe without rupturing the sclera and causing collapse of the globe, as occurred on the left side. "It is as though one pulled an apple from its stem." S. S.

BOOK NOTICES

Ophthalmic Operations. By HAROLD GRIMSDALE AND ELMORE BREWERTON. London: Baillière, Tindall & Cox. 2nd Edition, pp. viii. and 438. Figures in Text, 129. Price 18s. net.

The authors of this book have set before themselves a task which must involve enormous research, and is beset with numberless difficulties and pitfalls. They have had to say to themselves: "Shall we (1) describe all the operations which have been devised, or (2) select the standard few of which we approve, or (3) while exercising the right and duty of selection, introduce also some of the methods which we personally may or may not accept, but which are well approved by sound practitioners elsewhere?" Had they taken the first course and made no selection, their book would have been of enormous dimensions, and of a value which a mathematician might express as the reciprocal of the mass. Had they adopted the second, the title of the book would (as in the case of another work translated from a foreign tongue and published

a few years ago) have been quite misleading, because the area covered would have been very local. They have chosen the wisest course, the third, and have carried out their scheme to admiration. Of course, it would be easy to suggest adverse criticism. As a matter of fact, however, all the good standard methods, so far as we have observed, have their due relation given to them, and most, if not all, of the merely personal eccentricities have been quietly dropped out, and that is well.

Description alone would be very ineffective, and the text has accordingly been enriched by very numerous and most illuminating diagrams, though why these have been made so coarse and unlovely we do not understand. Clearness is the first consideration, no doubt, but without any sacrifice of clearness they might have been more elegant. In only one or two instances have we discovered any actual error in the illustrations; but take diagrams 102, 103, and 104: The question of the length of the incision is one of immense importance in cataract extraction, and we should condemn that depicted in 102 and 103 as too short; 104 agrees with the text, and is correct. Again, in Fig. 113 the incision is not placed sufficiently far from the corneal margin.

The authors commit themselves to the statement that general anaesthesia is required for enucleation, but a number of surgeons now-a-days employ local anaesthesia for this purpose, and are pleased with the method in suitable cases. They will find on inquiry that in many clinics the keratome is greatly preferred to the Graefe knife in iridectomy for acute glaucoma. Occasionally they have been led into speaking of an operation or an instrument by the name of a certain surgeon when his is a mere trifling variation upon one previously before the public. For operations such as those for relief of ptosis, shaving the eyebrow is apparently considered by them *de rigueur*, but that is not so at all; a thorough painting with iodine meets every requirement, and does not leave the patent with an atrocious deformity of months' duration.

Three omissions we note which we hope may be made good in all later editions: (1) the plan of a lattice stitching passing over a skin graft from and to fixed skin on each side, not piercing the graft at all but lying over it and holding it in position—a very useful and sound method; (2) Saemisch's incision in bad cases of hypopyon ulcer, a method which saves a little sight in many an eye otherwise doomed; and (3) extraction of a congenitally luxated lens which has slipped through into the anterior chamber. This accident is by no means very rare, and the manipulation and procedure merit a special paragraph.

There are a few points in which we do not quite agree with the authors, e.g., as to the intracorneal site of the keratome incision (pp. 264, 265), and in regard to a statement on p. 280, where "one

and all" of the advocates of simple extraction are made to say that under certain circumstances they prefer the separated combined operation, that is, extraction at an interval after a preceding iridectomy. As upholders of the simple method where conditions are suitable, we do not subscribe to any such doctrine. Nor are we satisfied that the remarks upon the theory of action of the iridectomy in glaucoma are quite just to the careful work of Henderson and others.

There is one common point in regard to which it seems to us that clarity is rather sacrificed and redundancy encouraged by the injudicious selection of typing. Take as an example pp. 195 and 196: all this (very handy) classification is repeated in fragments on the succeeding pages, whereas if a wiser selection of types and a more carefully considered spacing had been made, there would have been less repetition and a clearer scheme. In regard to all the grouped operations, it gives us pleasure to say that we admire and approve of the excellent little *esquisses* discussing various modes of approaching a problem, and the motives aimed at in different operative procedures, and, to some extent, appraising these.

We consider that the value of the book would be enhanced by a brief introductory chapter dealing with antiseptic methods as applied to the eye, the relative value of antiseptic and aseptic applications, and the merits of various local anaesthetics.

It will be manifest from what has been said that we consider this book to be very well deserving of the attention of all who are devoting, or who intend to devote, their lives to the practice of ophthalmic surgery. The scheme is excellent, and it is admirably carried out, the directions are clear, and the illustrations do really illustrate, and, even if they may be a little crude, are, as the authors justly indicate in their preface, vastly more useful than photographs of the actual performance, for these are never sufficiently precise to be of the slightest value to anyone.

Bulletin de la Société belge d'Ophtalmologie. No. 40, 1920. Bruxelles: Imprimerie medicale et scientifique (S.A.), 34, rue Botanique.

This thin volume (illustrated) includes an account of the fortieth meeting of the Society, held at Brussels on November 30, 1919. It contains several communications of interest, notably by Lagrange, on decompressive operations in chronic glaucoma, by Rutten on miners' nystagmus, and by Rasquin, on syphilitic irregularity of the pupil. These and some other communications will be noticed in our abstract columns in due course.

S. S.

Ophthalmological Society of Egypt. Bulletin of 1919 Cairo: printed by H. Waisel.

This book of 146 pages contains an account, mostly in English, of the proceedings of the sixteenth annual meeting of the Ophthalmological Society of Egypt, held on March 7, 1919, at the Kasr El Ainy Medical School, when fifty-nine members were present. Three of the now published communications appear in the *Transactions* of the Ophthalmological Society of the United Kingdom, and others have already been noticed in our columns. Text errors are few as compared with some of the recent volumes, but there is still room for improvemeut in this respect. The book would be easier to consult were it provided with an index.

S. S.

NOTES

Death

ADOLF STEIGER, whose work upon questions concerning the refraction of the human eye is widely known, died at Zurich on March 13th last, at the age of 58 years.

* * * *

Appointment

TH. MUSY has been appointed chief of the ophthalmological service of the cantonal hospital of Fribourg. M. G. Dobbyn and H. L. Ormerod have been appointed surgeons to the Bristol Eye Dispensary.

* * * *

Council of British Ophthalmologists

DURING the recent Congress of the Ophthalmological Society a general meeting, to which all British ophthalmic surgeons were invited, was held at the house of the Royal Society of Medicine, Wimpole Street, when the Report of the Council of British Ophthalmologists, which appeared in the last number of this journal, was adopted, after which certain changes in the rules were agreed upon. Sir Anderson Critchett occupied the chair.